UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

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GABRIEL STEIF and EVA STEIF,

08 CV 2892 (NRB)

Plaintiffs,

AFFIDAVIT

-against-

GREYHOUND LINES, INC. and WILLIAM LEE HENLEY, JR.,

Defendants.

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STATE OF NEW YORK)
) ss.:
COUNTY OF NEW YORK)

BRIAN D. GREENWALD, M.D. being duly sworn, deposes and says:

1. I have been retained as a medical expert on behalf of the defendants GREYHOUND LINES, INC. and WILLIAM LEE HENLEY, JR. in the above matter. I am a physician who specializes, and who is an expert, in the area of brain injury rehabilitation (including traumatic brain injury), including the diagnosis, care and treatment of brain injury. As an expert in this area I am thoroughly familiar with known and accepted means and methods of diagnosing (clinically and with diagnostic testing and equipment) brain injury. Brain injury would include diffuse axonal injury or "DAI". I have been treating brain injury patients as a part of my practice for nearly ten years. All of my opinions, findings and conclusions set forth below are with a reasonable degree of medical certainty.

MY QUALIFICATIONS

2. My qualifications in the field of brain injury, including traumatic brain injury, are set forth in my resume which is attached to and incorporated into this affidavit. (See Exhibit

"A") Briefly, I obtained my medical degree from the State University of New York at Stony Brook Medical School in 1995. From July 1995 to June 1996, I was an intern in internal medicine at U.C.S.F. Mount Zion Medical Center in San Francisco, California. From July 1996 to June 1999, I was a resident in physical medicine and rehabilitation at U.M.D.N.J./New Jersey Medical School. From July 1999 to June 2000, I was fellowship trained in traumatic brain injury rehabilitation at the Medical College of Virginia/Virginia Commonwealth University. From July 2000 through September 2003, I was the director of the Acquired Brain Injury Clinic, Director of Trauma Rehabilitation and an attending physician at The University Hospital in Newark, New Jersey. From September 2003 to April 2008, I was Associate Director of Brain Injury Rehabilitation, Department of Rehabilitation Medicine at Mount Sinai Medical Center in New York, New York. Since April 2008, I have been the Medical Director of Brain Injury Rehabilitation, Department of Rehabilitation Medicine at Mount Sinai Hospital in Manhattan. Mount Sinai Hospital is one of the leading hospitals in brain injury rehabilitation in the United States. Mount Sinai Medical Center is a Federally designated Model System of Care. There are only fourteen Model Systems in the United States. I am the Co Project Director of the New York Traumatic Brain Injury Model System. I have also been an attending physician in the Department of Rehabilitation Medicine at Mount Sinai Hospital since September 2003. I would like to further advise that I am Board Certified in Physical Medicine and Rehabilitation and I am licensed to practice medicine in the States of New York and New Jersey. My publications are set forth in my attached resume.

MR. STEIF'S BRAIN INJURY CLAIM

3. I am familiar with the facts and claims in this litigation, including the claim that Mr. Steif sustained a traumatic brain injury, more particularly DAI, due to his accident. This

claim is based upon the conclusion of Mr. Steif's psychiatrist, Dr. Daniel Kuhn, that Mr. Steif has DAI. (The DAI claim was subsequently repeated by Mr. Steif's neurologist Dr. Morton Finkel.) In somewhat oversimplified terms, DAI is a severing of the axons in the brain that occurs when the brain is suddenly moved inside the head. DAI is caused by high velocity, accerleration or deceleration, and/or angular rotation, forces acting upon the brain. "DAI results from damage to the [brain's] white matter caused by unequal rotation and/or deceleration/acceleration forces on the brain parenchyma, which stretch and injure the axons". [Ken Sugiyama, et. al., Diffusion Tensor Imaging Fiber Tractography for Evaluating Diffuse Axonal Injury, Brain Injury, April 2007; 21 (4): 413-419, attached as Exhibit **"J"**.]

MY OPINION REGARDING MR. STEIF'S NEUROLOGICAL INJURY

4. I am familiar with the claims in this litigation based upon my July 31, 2008 interview and examination of Mr. Steif (who is 71 years old—D.O.B April 25, 1937), my review of his videotaped deposition testimony and my review of Mr. Steif's medical records. The records include reports pertaining to CT scans of Mr. Steif's head taken at Bellevue Hospital immediately after the accident and at Mount Sinai Hospital two days after the accident. These CT scan reports are attached to my affidavit as Exhibit **"B"**. I have also reviewed the reports of Drs. Kuhn and Finkel, attached to my affidavit as Exhibit **"C"** and **"D"**. I have prepared two reports pertaining to Mr. Steif dated October 31, 2008 and November 17, 2008, copies of which are attached as Exhibit **"E"**.

5. Relevant medical records pertaining to Mr. Steif's February 27, 2008 accident which I have reviewed include the following:

i. The FDNY Pre Hospital care report dated February 27, 2008 that indicates that the initial Glasgow Coma Scale score total was 15. Mr. Steif is noled to be a 70-year-old male

(actually 71 year old) who was found supine on the ground. He was alert and oriented x3. He had a six-inch laceration on his forehead. He was complaining of pain in his head and his left hand. He was a pedestrian struck by a bus. Mr. Steif reported that there was a loss of consciousness.

ii. Admission notes from Bellevue Hospital Center from February 27, 2008, indicate that Mr. Steif was fully oriented and his neurological examination was within normal limits. Mr. Steif was admitted to Bellevue Hospital Center on February 27, 2008 and discharged on February 28, 2008. The Discharge Summary reports that Mr. Steif has a history of atrial fibrillation and was on Coumadin when he was struck by a bus on February 27, 2008. He had facial and occipital lacerations with complaints of right-sided chest pain.

iii. Significantly, a CT scan of the head from February 27, 2008, at Bellevue Hospital Center shows prominent sulci, consistent with age-related volume loss. (This means that as of the time of his accident Mr. Steif had age related brain atrophy also known as thinning of the brain's cotex.) No focal areas of abnormal attenuation were identified within the parenchyma of the brain. The impression was no acute intracranial pathology. Right frontal skin laceration extends to calvarial surface. Small left temporal calcified meningioma versus volume averaging. Left maxillary sinusitis. (A copy of the CT scan report is attached as part of Exhibit **"B"**.)

iv. Mr. Steif was transferred to Mount Sinai Medical Center for further care on 02/28/2008. He was admitted by Dr. Michael Bronson for orthopedic care. A CT scan of the head done at Mount Sinai Medical Center on 02/29/08 showed, among other things nonspecific diffuse atrophy. (This means that as of the time of his accident Mr. Steif had age related brain atrophy.) Prominence of the extra-axial space over the frontal convexities, possibly secondary to

cerebral atrophy. The impression was no acute intracranial findings. (A copy of the CT scan report is attached as part of Exhibit **"B"**.)

v. A Mount Sinai neurologic consultation from 02/29/2008 reported that Mr. Steif awoke from his injury with good recall and orientation. He was fully oriented, had good recall and no language deficits on examination. Impression was cerebral concussion. Mr. Steif was discharged on March 6, 2008.

vi. I reviewed the report from Dr. Lewis Rothman dated August 8, 2008 (attached as Exhibit **"F"**). According to Dr. Rothman, the CT scans of head from 2/27/08 (Bellevue) and 2/29/08 (Mount Sinai) show no intracranial injury. Both scans show multifocal cortical (brain) atrophy. These were findings made by Bellevue Hospital and Mount Sinai Hospital radiologists as well.

6. Based upon my review of the records, my interview of Mr. Steif and my examination of Mr. Steif, I have concluded with a reasonable degree of medical certainty that Mr. Steif is a 71-year-old man with a past medical history of significant cardiovascular disease who is status post being hit by a bus February 27, 2008. Mr. Steif sustained a mild concussion which has resolved. CT scans of the brain have not shown any injury. The CT scans of the brain do, however, show evidence of cortical atrophy consistent with age related thinning of the brain cortex.

DR. KUHN'S UNRELIABLE METHODOLOGY

7. While it is my opinion that the only neurological injury that Mr. Steif sustained as a result of his accident was a mild concussion which resolved, Dr. Kuhn opines that Mr. Steif sustained DAI. Dr. Kuhn's DAI conclusion cannot withstand scrutiny and cannot be stated with any degree of medical certainty since his methodology in arriving at this conclusion is unsound

and unreliable. The two major reasons why Dr. Kuhn's methodology is unsound are that he failed to use differential diagnosis and he did use quantitative electroencephalogram—an error prone methodology that does not have general acceptance in the medical community for the diagnosis of traumatic brain injury.

The Differential Diagnosis Problem

8. Dr. Kuhn's DAI diagnosis is unreliable and unsound since he did not arrive at his diagnosis by differential diagnosis. Differential diagnosis is the proper and accepted methodology of determining what are the possible conditions a patient has based on history, physical examination and testing. Differential diagnosis is a standard methodology used by physicians for identifying the cause of a medical problem by eliminating likely causes until the most likely cause is isolated. Dr. Kuhn's diagnosis and methodology are unreliable since he failed to consider Mr. Steif's documented brain atrophy. Nowhere in Dr. Kuhn's reports does he mention or refer to the reports of the head CT scans taken at Bellevue Hospital on February 27, 2008 and at Mount Sinai Hospital on February 29, 2008. Dr. Kuhn did not rule out Mr. Steif's age related brain atrophy as a cause or the cause of Mr. Steif's reported or claimed cognitive/memory problems. Instead, relying upon quantitative electroencephalogram, Dr. Kuhn leaps to the conclusion that Mr. Steif has DAI due to the subject accident. [I would like to advise the Court that the findings Dr. Kuhn reported on Mr. Steif's mental status exam are related to age related changes. The CT scans of Mr. Steif's brain showed no objective evidence of trauma but did show objective evidence of age related cortical atrophy (thinning). These objective structural changes are consistent with the age related memory impairments.]

The QEEG Problem

9. As discussed below, the use of quantitative electroencephalogram is flawed, has not been given favorable peer reviews for the diagnosis of DAI, has an unacceptable rate of error for diagnosing DAI (an unacceptably high false positive rate) and has not gained general acceptance in the medical community that diagnosis and treats brain injury patients. Simply put, quantitative electroencephalogram cannot be reliably used to diagnose DAI. Dr. Kuhn's testing method is not an appropriate, accepted or valid method to diagnose traumatic brain injury and/or diffuse axonal injury. Mr. Steif has age related cerebral cortical atrophy of previous CT scans of his brain. Mr. Steif did not sustain memory impairment as a result of the accident.

10. The method that Dr. Kuhn basis his DAI opinion upon is quantitative electroencephalogram ("EEG") i.e. quantitative EEG or "QEEG". EEG involves placing electrodes on a patient's head/scalp in order to record the brain's electrical activity. Quantitative EEG is a statistical/mathematical analysis of EEG data. In the article entitled "The Value of Quantitative Electroencephalography in Clinical Psychiatry: A Report by the Committee on Research of the American Neuropsychiatric Association" which appeared in the Fall 2006 Journal of Neuropsychiatry and Clinical Neurosciences, it was noted that QEEG "involves computer-assisted imaging and statistical analysis of the EEG for the detecting abnormalities".

11. In QEEG analysis the patient's EEG results are compared to a database of EEG results (factors or discriminants) obtained from a group of unknown individuals. For example, in Dr. Kuhn's 10/9/08 report, page 2, Dr. Kuhn states that his QEEG analysis utilizes the "Neuroguide database". Dr. Kuhn noted that this database is "based on 2,831 variables and includes measures from some 625 normal individuals and over 5,000 clinical cases". An example of the unreliability of QEEG is that nothing is known about the 625 "normal"

individuals nor the 5,000 "clinical" ("not normal") cases (individuals) that form the Neuroguide database that Mr. Steif was compared to. The demographics and background of the individuals comprising the Neuroguide database are not known e.g. their ages, their race or ethnicity, their medical history, the nature of the condition(s) the "clinical cases" suffered from, whether any of the individuals comprising the database were on medication when their respective EEG data was collected, etc. There is no way to know whether any of the individuals comprising the database and who Mr. Steif was compared to were anything like him. There is no way to know whether the individuals Mr. Steif was compared to were infants, toddlers, children, teenagers, young adults, adults the same age as Mr. Steif, or adults that were older. Unless Mr. Steif was compared to someone exactly like him in terms of his medical and physiological condition other than the claimed DAI it would be impossible to ascertain if Mr. Steif's QEEG findings were indicative of any "abnormal" condition, such as DAI. As one author noted when discussing the value of QEEG: "In normative comparisons patient must be compared to his or her own age group, because EEG frequency content varies considerably with age." Nuwer M., Hovda DA, Schrader LM, Vespa PM., Routine and Quantitative EEG in Mild Traumatic Brain Injury, Clinical Neurophysiology 2005; 116: 2001–2025, p. 2015.

12. There are no published uniform standards that set forth how many individuals should comprise the QEEG database, how the individuals comprising the database should be selected or which of the collected EEG results should be used as the baseline for comparison purposes. This clearly establishes the unreliability of QEEG methodology to prove or establish mild traumatic brain injury such as DAI. Similarly, in QEEG analysis the abilities/qualifications of the individual(s) collecting the EEG results comprising the database is unknown.

13. Supportive of my critique of Dr. Kuhn's methodology are three authoritative peer review articles that critique the use of QEEG to diagnose mild traumatic brain injury (such as DAI). The articles are: Nuwer M., Assessment of Digital EEG, Quantitative EEG, and EEG Brain Mapping: Report of the American Academy of Neurology and the American Clinical Neurophysiology Society, Neurology 1997; 49:277-292 ["Nuwer Article 1"], Exhibit **"G"** annexed hereto; Nuwer M., Hovda DA, Schrader LM, Vespa PM., Routine and Quantitative EEG in Mild Traumatic Brain Injury, Clinical Neurophysiology 2005; 116: 2001–2025 ["Nuwer Article 2"], Exhibit **"H"** annexed hereto; and Coburn K., et. al., The Value of Quantitative Electroencephalography in Clinical Psychiatry: A Report by the Committee on Research of the American Neurophyschiatric Association., J. Neuropsychiatry Clinical Neurosci 18:4, Fall 2006 ["Coburn Article"], Exhibit **"I"** annexed hereto.

14. The above peer review articles are in well established and respected publications and have been written and published by the authors on behalf of major organizations (The American Academy of Neurology, The American Clinical Neurophysiology Society [formerly The American Electroencephalographic Society] and the American Neuropsychiatric Association) that concern themselves with neurology and neurological issues such as brain injury and DAI. These articles do not look favorably upon the use of QEEG methodology to diagnose traumatic brain injury including DAI. They point out flaws in QEEG methodology and they point out the unreliability of QEEG to establish DAI (e.g. unacceptable false positive results). In addition to my opinion, these articles clearly establish that QEEG has an unacceptable rate of error and has not gained general acceptance in the medical community that diagnosis and treats brain injury patients.

15. Below, I would like to point out some of the highlights of the Nuwer Article 1, Nuwer Article 2 and the Coburn Article, which I am in agreement with.

16. In Nuwer Article 1 (Exhibit "G"), where Dr. Nuwer assesses the use of QEEG as a clinical tool, he indicates:

> Although much scientific literature has been produced after decades of research in this field, there remains controversy about the clinical role of QEEG analysis techniques. [p. 277]
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> *Problems.* Despite such potential advantages, QEEG's clinical usefulness is now quite limited, although it has substantial potential for future applications. At this time, most scientific reports more convincingly have demonstrated research applications rather than clinical applications. [p. 279]
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> *Head injury.* Several published studies have addressed EEG brain mapping and other QEEG analysis techniques in patients with head injury. Some reports are uncontrolled, unblinded, or retrospective observations, which are difficult to use for assessing clinical utility…Others have commented that this technique is predisposed to false-positive "abnormalities" in normal subjects due to mild drowsiness or other problems…based on the available published literature, EEG brain mapping and other QEEG techniques have been reported to show very interesting changes in some studies. However, evidence of clinical usefulness or consistency of results are not considered sufficient for us to support its use in diagnosis of patients with postconcussion syndrome, or minor or moderate head injury. [p. 283]
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> ***
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> *Medical-legal abuse.* In some trial law and insurance circulars and advertisements, EEG brain mapping and other QEEG techniques have been cited as reliable tests. A major disadvantage of these tests in legal disputes is the occurrence of false-positive results, i.e., "abnormal" results in normal subjects and

incorrect diagnosis in patients. Results also can be dramatically altered during the subjective process of selecting portions of an EEG for quantitative analysis. There are no objective safeguards to prevent statistical or unintended errors. Probative value and even the test-retest reproducibility can be poor. There is great potential for abuse...on the basis of clinical and scientific evidence, opinions of most experts, and the technical and methodologic shortcomings, QEEG is not recommended for use in civil or criminal judicial proceedings. [p. 284]

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Summary. E. On the basis of current clinical literature, opinions of most experts, and proposed rationales for their use, QEEG remains investigational for clinical use in postconcussion syndrome, mild or moderate head injury...F. On the basis of clinical and scientific evidence, opinions of most experts, and the technical and methodologic shortcomings, QEEG is not recommended for use in civil and criminal judicial proceedings.

17. In Nuwer Article 2 (Exhibit **"H"**), where Dr. Nuwer again assesses the use of QEEG as a clinical tool, he indicates:

The EEG changes in MTBI [such as DAI] are likely to be similar to those seen in many other congenital or acquired brain disorders. [p. 2005]

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Many decades of research and clinical experience with routine EEG carry with them important lessons for clinical interpretation of studies on patients after MTBI. These are needed not only for clinical interpretation of the routine EEG, but also for our QEEG discussion below. After all, QEEG is just measurements made on the EEG. [p.2006]

3.3 Correspondence between EEG changes and clinical symptoms

All this has led some authors to consider that the EEG is of very little practical value in follow up after head injury (Claes, 1961; LeBlanc, 1999; Meyer-Mickeleit, 1953; Muller, 1955; Mueller, 1957; Radermecker, 1964). PCS symptoms can be neither proven nor denied by any kind of EEG (Caveness, 1966; Courjon, 1962; Kugler, 1966). [p. 2007]

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3.5. Problems using EEG for diagnosis and prognosis after mild traumatic brain injury

The two prominent French and Austrian neurologists and neurophysiologists J. Courjon and E. Scherzer warned long ago about problematic or misleading use of EEG. These warnings apply especially to MTBI. Although originally penned for routine EEG, their comments apply well too to QEEG. They noted, 'The implications drawn from a detailed EEG report can never be absolute and imperative, apart from very rare exceptions. The electroencephalographer has to enumerate all the etiological possibilities of a certain EEG picture and give the degree of their probability in accordance with the clinical data'...Regarding misleading and oversimplified interpretations of EEG in medical-legal settings, Courjon and Scherzer warned, 'Either it is deduced from a pathological EEG that traumatic brain damage has occurred which may be the cause of subjective symptoms, or from a normal EEG it is deduced that no traumatic brain damage could have occurred and that no subjective symptoms should be present. Both conclusions are obviously fallacious'. These issues and warnings about routine traditional EEG should be kept in mind when reviewing QEEG studies and claims. [p. 2008-2009]

4.2.2 Assessing QEEG as a diagnostic test

Assessment of clinical usefulness includes several factors (Nuwer, 1992). The primary factor in assessment is peer-reviewed published studies. [p.2010]

4.2.2.1 Cause and age of injury.

The differential diagnosis for the cognitive complaints of post-concussion syndrome or mild head injury includes side effects of medication, depression and bipolar disorder, anxiety, panic attacks, post-traumatic stress disorder, insomnia and other sleep disorders, pre-existing mild brain disorders, early dementia, and other conditions. Drowsiness, anxiety and medications, including benzodiazepines and antidepressants, affect the EEG. If a QEEG shows 'abnormalities', what do those changes mean? How can those QEEG findings help to narrow the differential diagnosis? [p. 2010-2011]

How sensitive are mild head injury QEEG diagnostic discriminants to common injuries, such as striking a person's head on a cabinet door or slipping on an icy sidewalk? [p. 2011]

4.2.2.2. Value:

One considers what clinical conclusions can be drawn...QEEG panels and discriminants often seem indiscriminant. QEEG panels provide hundreds or thousands of pieces of information e.g., measurements of many EEG features. Too often, no compelling rationale is presented for how the information is to be used to fulfill the clinical mission or effectiveness as discussed above. This is a major shortcoming of QEEG in MTBI patients. [p. 2011]

4.2.4. Reproducibility and reliability

QEEG clinical interpretation is plagued by false positives...Overall, these studies show measurement reproducibility, but they did not assess the QEEG's medical reliability as a diagnostic test. They do not show medical diagnostic reliability because they did not assess whether the measurements give correct medical diagnosis. [p. 2013]

4.3. Problems with QEEG statistical normative comparisons

Many types of problems interfere with QEEG, especially for statistical normative comparison testing. [p. 2014]

4.3.1 Artifacts, medications, state, and technical factors

Artifact contamination, drowsiness, anxiety, medication and technical factors can make a QEEG appear falsely abnormal. [p. 2014]

Artifacts readily contaminate any EEG recording. Eyes, muscles, sweat, nearby equipment, poorly connected scalp electrodes, and many other sources generate these undesired signals. In QEEGs, they readily cause confusing patterns (Nuwer, 1987, 1988). Traditional artifact removal tactics can be insufficient for several reasons,...Many QEEG recordings merge EEG and these contaminants, causing spurious results in frequency analysis, normative comparisons, discriminant analysis, and brain map findings. [p. 2014]

Drowsiness occurs frequently in EEG recordings...QEEGs can confuse early drowsiness with signs of brain damage...Anxiety interferes with the resting state needed for the posterior alpha. [p. 2014]

4.3.2 Meaningless and non-specific changes

'Different' is not the same as 'diseased.' Computers can measure how one patient's EEG differs from an ideal average patient, but such a difference may be benign and of no medical significance...In QEEG measurements, this kind of a confusion frequently is seen. Some QEEG readers erroneously assume that any difference from average is due to disease. Really, though different people often are simply different from each other. [p. 2014]

Normal people have many QEEG statistical 'abnormalities', so the concept of QEEG 'abnormality' becomes somewhat meaningless. QEEG panels measures

hundred or thousands of individual EEG features, each statistically transformed and tested. Statistics meant to test a few features are applied to enormous numbers of features, leading to many false positives 'abnormalities'. And these statistics have their own chance events; ***normal individuals may have a 2 to 18% false positive rate*** (Dolisi et al., 1990). The QEEG, when measuring thousands of features, always flags some features as outside the normal range even in a normal healthy person…A variety of disorders can cause the same results (Coutin-Churchman et al., 2003; Mies et al.,1984). QEEG does not differentiate among diagnosis. A serious, common reading error is to attribute QEEG changes to a single specific diagnosis. Most real EEG or QEEG changes are non-specific…In normative comparisons patient must be compared to his or her own age group, because EEG frequency content varies considerably with age. Consider a database with 625 normal subjects from age 2 months to 82 years (Thatcher et al., 2003a). Most of those subjects were children. Among adults, 24 subjects were 18-21 years old, 21 were 21-25 years old, 22 subjects in the group averaging 30 years of age, and 32 subjects in the older group averaging 57 years of age. This means that EEGs for most adults are compared to 21-32 normal control subjects of their own age group. [pp. 2014-2015]

4.3.3. Who reviews the EEG and selects the epochs for analysis?

There are no generally accepted standards for QEEG processing. Proposed guidelines (Duffy et al., 1994) often are not followed and are not generally accepted…Even when careful processing has been carried out, there are no clear rules about interpretation. How many statistical hits are needed to deduce that something is truly abnormal? Does a reader really have to read the EEG tracing too? When do changes imply a particular diagnosis? What significance is attached to 'abnormal' results? These open questions have not been sufficiently answered….The lack of accepted standards and safeguards leaves this field open to erroneous results. [pp 2015-2016]

4.4.3. Diagnostic discriminants

Thorton (1999) tested the Thatcher head injury discriminant on 39 head injury patients and in normal subjects. It was positive in 81% of patients who had no significant loss of consciousness, and in 71% patients who did have a significant loss of consciousness. However, the Thatcher discriminant had ***a false positive rate of 52%*** on prospectively tested normal subjects. Such a high false positive rate raises serious questions about the diagnostic accuracy of this head injury discriminant. [p. 2018]

5. Summary

QEEG diagnostic discriminant testing reports and commercial marketing make claims that they can identify MTBI. The Thatcher mild head injury discriminant makes counterintuitive claims that the EEG changes are unaffected by drowsiness, sleep, or medications well known to affect EEG. That diagnostic discriminant failed to show good accuracy when evaluated by Thorton or in civilian injuries tested by Trudeau…These claims still need impartial corroboration and prospective validation.

QEEG panels and diagnostic discriminants still have many unresolved problems. These include the effects of artifact contamination, drowsiness, medications, and technical changes. Some 'abnormalities' actually are meaningless and non-specific distinctions from normal. ***False positive rates can be high, even greater than 50% among normal persons***…There are no generally accepted safeguards and standards…This and other factors raise the credibility threshold for accepting the results. [p. 2021]

Overall, the disadvantages of QEEG panels and diagnostic discriminants presently outweigh the advantages of those studies for the diagnosis of MTBI. More well designed prospective studies are needed. Diagnostic QEEG users need to remedy the procedural shortcomings. [p. 2021]

18. In the Coburn Article (Exhibit **"I"**), "The Value of Quantative Electroencephalography in Clinical Psychiatry", written on behalf of the Committee on Research of the American Neuropsychiatric Association", the following is noted regarding the reliability of QEEG:

> Quantitative EEG (qEEG) involves computer assisted imaging and statistical analysis for the EEG detecting abnormalities, assisting the physician in making a diagnosis, and other purposes relating to patient care.
>
> Previous reviews of this area have lumped together two types of studies: Those focusing on the direct clinical applicability of currently available qEEG systems and those involving more speculative area of qEEG research. Consequently, it remains unclear whether qEEG is ready to be used as a standard laboratory test by practicing psychiatrists. A pivotal question remains unanswered concerning the actual clinical utility of qEEG and related electrophysiological methods: are the techniques sufficiently sensitive and specific to answer practical clinical questions about individual patients suffering from recognized psychiatric disorders?...The focus of this report is on whether presently available qEEG systems can tell the practicing psychiatrist anything of practical importance about the individual patient sitting across the desk from him. Its conclusions are less glowing that might be expected on the basis of previous reviews because, although qEEG can provide information of direct clinical relevance, even the most sophisticated qEEG systems now available are still very limited. [p.461]

19. Dr. Coburn notes that due to the unreliability of QEEG in diagnosing traumatic brain injury such as DAI, this topic is excluded from his article. He states at page 461: "Psychiatric conditions thought to arise secondary to brain damage (e.g., stroke, traumatic brain injury) or infection (e.g., systemic lupus erythematosus) are excluded, due to the difficulty of

determining whether any subsequent psychiatric condition is primary or secondary". He then addresses, in general, the flaws of QEEG including the QEEG database (like the Neuroguide database that Dr. Kuhn relies upon). Dr. Coburn states:

> Serious controversy begins when qEEG data recorded from a patient are compared statistically with normative databases, on the assumption that clinically significant psychiatric disturbances may be accompanied by statistically significant abnormalities in brain activity.
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> However, normative databases differ in their composition and quality; a qEEG measure deemed abnormal by comparison with one may be normal when compared with another. Since most normative databases are proprietary products, they are difficult to compare systematically and generally have not had their details published in the open literature. For all such comparisons of a patient with a healthy control group, it is assumed that patients and controls differ only in the presence of abnormal brain activity underlying the patient's disorder. Unfortunately, many patients do not match the often-stringent selection criteria for the normative healthy group (e.g., no history of neurological or psychiatric disorder, no first degree relatives with such disorders, no hypertension or diabetes, no psychoactive medications, etc.)...It must be realized that statistically, such "hyper-healthy" controls are abnormal...The use of hyper-healthy subjects as opposed to more carefully matched "street normal" controls inflates the type I (false positive) error rate. [pp.463-464]

20. Dr. Coburn concludes the article by summarizing the limited uses of QEEG. Noticeably absent is any mention of using QEEG to aid in the diagnosis of traumatic brain injury such as DAI. The article concludes:

> Used cautiously and with appropriate recognition of its limitations, qEEG offers the clinician an accurate laboratory test to aid in the detection and differential diagnosis of several common neuropsychiatric disorders. These include both disorders of childhood, such as learning disabilities and attention-deficit disorders, and those occurring primarily during adulthood, such as depressive, bipolar, and dementing disorders. Additional uses of qEEG showing promise but not yet sufficiently developed routine clinical application include the prediction of medication efficacy and the prediction of the clinical course of a disorder. [p. 495]

21. Another authoritative peer review article which I rely upon is Ken Sugiyama, et. al., Diffusion Tensor Imaging Fiber Tractography for Evaluating Diffuse Axonal Injury, Brain Injury, April 2007; 21 (4): 413-419 ["Sugiyama Article"], attached as Exhibit **"J"**. In the article Dr. Sugiyama notes that "[c]urrently, no technique is accurate for diagnosing and assessing the distribution of DAI…CT and conventional MRI are known to underestimate the true extent of DAI…Consequently, there is considerable interest in developing more sensitive diagnostic tools".

22. The only diagnostic tool which Dr. Sugiyama indicates has promise is diffusion tensor imaging – not QEEG.

Evoked Potential Tests

23. Dr. Kuhn's reports indicate that he performed Evoked Potential tests (auditory visual and somatosensory) on Mr. Steif. Generally, evoked potential testing measures electrical activity in the brain in response to sight, sound or touch stimulation. The visual evoked potential test (sometime referred to as a visual evoked response test) involves the patient watching a flashing checkerboard pattern on a screen and then recording the brain's electrical pattern. Dr. Kuhn claims in his report that Mr. Steif's visual evoked potential results support a DAI

diagnosis. However, there is absolutely no general acceptance (or any other kind of acceptance) in the medical community that diagnosis and treats brain injured patients that evoked potential testing, including visual evoked potential testing, can be used to diagnose DAI. There is no peer review literature that supports such use of evoked potential tests. In fact, Dr. Nuwer states in Nuwer Article 1:

> Visual and auditory long-latency evoked potentials have also been used along with EEG brain mapping techniques. At present, insufficient information is available about evoked potential topographic mapping and statistical normative scoring to assess its normal variants, normal limits, effects of medication, and other relevant technical and patient-related factors. No well-designed, prospectively verified clinical studies have demonstrated the clinical utility of topographic mapping of long-latency evoked potentials for diagnosis in clinical settings. [p. 280]

24. Furthermore, just as QEEG is noticeably missing from the Coburn Article as a technique for diagnosing DAI, so is evoked potential testing.

CONCLUSION

25. I would like to conclude by reiterating that Dr. Kuhn's methodology and procedures for concluding that Mr. Steif has DAI are flawed, not favorably reviewed in peer review articles, error prone, unreliable and/or not generally accepted in the medical community that diagnosis and treats brain injury, including DAI.

Brian D. Greenwald, M.D.

Sworn to and subscribed before me
this 03 day of February, 2009.

Notary Public

DONNA O'ROURKE
Notary Public, State of New York
No. 4989860
Qualified in Westchester County
Commission Expires 12/19/09

Gabriel Steif and Eva Steif v. Greyhound Lines, Inc. and William Lee Henley, Jr.
Index Number: 08 CV 2892
Our File Number: 818-34751

CERTIFICATE OF SERVICE

This is to certify that a copy of the foregoing **AFFIDAVIT OF DR. BRIAN GREENWALD and EXHIBITS,** was served via ECF and personal delivery this 3rd day of February, 2009, upon:

JAROSLAWICZ & JAROS, LLC
Attorneys for Plaintiffs
GABRIEL STEIF and EVA STEIF
225 Broadway - 24th Floor
New York, New York 10007

Kevin B. Pollak (6098)

Sworn to before me this
3rd day of February, 2009.

Notary Public

SANDER N ROTHCHILD
Notary Public, State of New York
Commission Expires [illegible] 10